

Synopsis V1.0
Single Event Effects Testing of the Micropac 53111
Optocoupler (5962-9314001HXA-X03)

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Proton SEE Test Date: October 25, 2006

Heavy Ion SEE Test Date: November 16, 2006

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I. Introduction

This study was undertaken to determine the single event destructive and transient susceptibility of the Micropac 53111 Optocoupler (5962-9314001HXA-X03). The device was monitored for transient interruptions in the output signals for proton testing at University of California Crocker Nuclear Lab (UCD) and for destructive events induced by exposing it to a heavy ion beam at the Texas A&M University Cyclotron Single Event Effects Test Facility (TAMU).

II. Devices Tested

The 53111 is a single channel, hermetically sealed, power MOSFET optocoupler. Functionally, the device operates as a single-pole, normally open solid-state relay. The device is actuated by an input current, which can be supplied from standard logic types such as open-collector TTL. The input current biases a light emitting diode that is optically coupled to an integrated photovoltaic diode array. The photovoltaic array powers control circuitry that operates the output MOSFETs.

The sample size used during the tests was three devices for proton testing and two for heavy ion testing, for a total of five devices. The devices were manufactured by Micropac and were characterized prior to exposure. The devices tested had a Lot Date Code of 0103. All DUTs' package markings were identical and are given in the table below:

TOP	BOTTOM
mii -31757 usa	8475
53111-X	
5962-9314001HXA	
^ # Q0103	

III. Test Facilities

Facility: University of California at Davis Crocker Nuclear Laboratory
Protons: 63 MeV

Flux: 1.7×10^8 to 8.0×10^9 protons/cm²/s.

Facility: Texas A&M University Cyclotron Single Event Effects Test Facility,
15 MeV/amu tune.

Flux: 1.9×10^3 to 5.3×10^4 particles/cm²/s.

TAMU Ion	Incident LET (MeVcm ² /mg)
Ar	8.1
Kr	26.8
Xe	49.8
Au	83.4

IV. Test Methods

The hardware used for this testing is diagramed in Figure 1. For the transient testing, that was done using protons (device construction prohibited transient testing with heavy ions), the pulse generator was set to a dc value (grounded) to maintain the LED in the off state. The output stage was biased at either 28 or 34 volts. Two scope probes were attached to the two output stages of the DUT and fed into a digital scope, set to trigger on any negative going pulses (from the pull-up voltage of either 28 or 34 volts) that are more than 200 mV from the pull-up voltage. A PC using a LabView controlled GPIB is used to control the test setup and to download and store any transients captured by the digital scope.

For the Single Event Gate Rupture (SEGR) testing performed at TAMU, testing needed to be done for both biased and unbiased conditions. Additionally, since the only indication that one would have a failure, is a failure for the device under test (DUT) to switch, the pulse generator was set to toggle the output state at a frequency of 1 Hz using a 1 ms pulse. Therefore, testing was done with the output bias at 0, 28 and 34 volts and the input stage pulsed to generate an “alive” signal from the DUT.

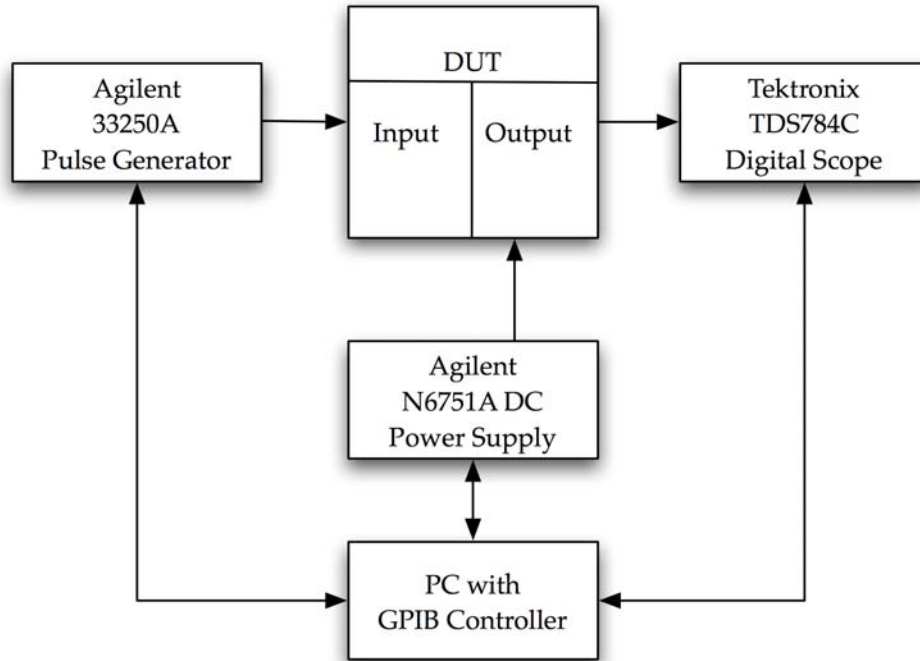


Figure 1. Test fixture block diagram

V. Results

Single Event Gate Rupture

Two parts, biased as described above, were tested with heavy ions with LETs ranging from 8.1 to 49.8 MeV-cm²/mg, with at least 10⁷ ions/cm² at each LET value and at 83.4 MeV-cm²/mg, with at least 3 × 10⁶ ions/cm². In no test condition were any destructive conditions observed that would indicate an SEGR or other destructive mode. Therefore, the Micropac 53111Optocoupler (5962-9314001HXA-X03) is considered to have an LET threshold for destructive events of greater than 83.4 MeV-cm²/mg.

Single Event Transients

Three parts, biased as described above, were tested with 63 MeV protons with at least 1 × 10¹² protons/cm². In no test condition were any transients observed. Therefore, the Micropac 53111Optocoupler (5962-9314001HXA-X03) is not considered to be sensitive to protons for the production of transients.